

# The Nature of Authentic Professional Development During Curriculum-Based Telecomputing

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## Abstract

*What do teachers learn about their teaching when their students engage in curriculum-based online learning projects? This qualitative study explores beliefs about on-the-job, profession-related learning—or “authentic professional development”—among eight teachers whose students participated in educational projects hosted by five well-established programs: The Electronic Emissary, iEARN, KidLink, ThinkQuest, and ThinkQuest Jr. Telecomputing alone does not change teachers’ teaching styles. Instead, teachers who are innovative, inquiry based, and student centered may find telecomputing to be a useful tool for helping their students become more confident, self-directed learners. (Keywords: professional development, educational telecomputing, instructional change, teacher perceptions.)*

Telecomputing makes available authentic learning opportunities that connect students to the world beyond the classroom. As examined in this study, learning during online projects may also include teachers’ on-the-job “authentic professional development,” allowing them to explore their teaching effectiveness and their students’ best ways of learning.

The “electronic classroom” has been advocated as essential to 21<sup>st</sup> century school reform and educational improvement (e.g., Philips, 1994; Riley, 1999). Computers installed in classrooms and connected to the Internet have dramatically increased, with 99% of U.S. public schools reporting computers with access to the Internet by 2002 (NCES, 2003).

Because the use of telecomputing in classroom teaching is fairly new, research on the effects of classroom computers with Internet connections is also relatively new. Such research has resulted in varied findings, with some claiming beneficial effects among students who use computers (e.g., Cadiero-Kaplan, 1999; Dockstadter, 1999; Idaho Council for Technology in Learning, 1999), while others have disputed these claims (e.g., Dickey & Roblyer, 1997; Mergendoller, 2000) or have found no evidence of significant benefits for students that are attributable specifically to their use of computers (e.g., Bennett, 1999).

Assessing the effects of teachers’ use of telecomputing tools in the classroom is difficult in part because teachers use these tools in many ways. For example, Harris (1998) identified various ways in which teachers use telecomputing in the classroom as “activity structures” (p. 7)—meaning teacher-constructed, student-centered online learning activities—and grouped them into general categories, including the following:

**Information collections**—exchanges of information about various topics, electronic publishing of information, tele-field trips, and pooled data analysis shared student to student or classroom to classroom;

*Problem-solving projects*—information searches, simulations, electronic process writing, and social action projects; and

*Interpersonal exchanges*—keypals (e-mail pen pals), electronic mentoring (also called telementoring), and global classroom exchanges.

When computers first began to be installed in classrooms, expectations rose that they would have beneficial effects on teaching (e.g., Campoy, 1992). Some expected that the availability of telecomputing tools in classrooms would change them into project-based, “hands-on,” student-directed, or constructivist learning centers (e.g., Collins, 1991; Means et al., 1993). However, Kleiman (2000) found that there are challenges that the educational system has had to face in terms of classroom technology use, with one of the most important findings being that the educational system is not prepared for a new curriculum style. In addition, teachers are not prepared to use the new technology in innovative ways that support major curriculum goals. Wenglinsky (1998) concluded that, with technology in the classroom, use of the technology is less important than how effectively it is used by teachers for instructional purposes.

Some researchers have determined that, despite the increase in Internet-connected classroom computers, relatively few teachers use the Internet to teach (Becker & Ravitz, 1999; Becker, 1999; Love & McVey, 2000). Other research has shown that computer use alone has not greatly changed teachers’ teaching methods (e.g., Dexter, Anderson, & Becker, 1999). Although technology alone may not significantly change teachers’ classroom practice, McGee (1997, 1998) found significant “unintended professional learning” occurring among teachers whose students participated in curriculum-based online projects. Harris and Grandgenett (2002) extended that concept as follows:

If professional development is understood to be teachers’ professional learning, then authentic professional development occurs when [teachers] actively learn—and reflect on that learning, both individually and collaboratively—as [they] teach. (p. 55)

In this research study, the naturally occurring on-the-job professional learning related to teachers’ active learning about their classroom practice is called “authentic professional development” as identified by Harris and Grandgenett (2002).

## RESEARCH FOCUS

This study explores the nature of authentic professional development occurring among teachers whose students participate in curriculum-based telecomputing projects. McGee’s research (1997, 1998) examined professional learning occurring among teachers engaged in one telecomputing program, The Electronic Emissary Project; this study examined the experiences of eight teachers involved in five curriculum-based online programs to see if similar profession-related learning occurred among teachers participating in other types of curriculum-based telecomputing projects. In addition to The Electronic Emissary

Project, this study included teachers participating in projects with The International Education and Resources Network (iEARN), KidLink, ThinkQuest, and ThinkQuest Jr.

### **Telecomputing Programs Selected for This Study**

In addition to being long established, the five curriculum-based programs through which the teachers in this study participated in online activities are relatively well known and are generally respected as educational resources. For example, three of these projects—KidLink, iEARN, and ThinkQuest—are included on a Stanford University shortlist of Internet projects recommended for K–12 schools (Martin, 1998), while The Electronic Emissary Project was described by The Resource Center of the Corporation for National and Community Service as “one of the most successful online tutoring programs of its kind” (Cravens, 2003). Additional details are provided below along with the individual descriptions of each program.

These programs represent varied learning activity structures (Harris, 1998). Although the format or types of activities they offer may vary, these programs are all dedicated to one primary mission—providing learning opportunities to students through telecomputing.

#### ***The Electronic Emissary Project***

The Electronic Emissary Project ([emissary.wm.edu](http://emissary.wm.edu)) has been online continuously since February 1993. It originated at The University of Texas at Austin, and moved to William & Mary in fall of 2002. In 2001, this program was a finalist in the international Stockholm Challenge Award (Stockholm Challenge, 2001). It was also recommended by ServiceLeader.org as a “very successful and well-documented national telementoring program” (ServiceLeader.org, 2000).

The Electronic Emissary uses electronic mentoring, also called telementoring, which is a form of interpersonal exchange. A subject matter expert (SME, pronounced “smee”) volunteers to mentor students during a class’s study of topics with which the SME has expertise. Teachers select a SME from the Electronic Emissary database and request an online collaboration. When this “match” is arranged, e-mail correspondence begins between the SME and the teacher and/or students. During the project, this exchange is monitored by Electronic Emissary staff members acting as facilitators.

#### ***KidLink***

KidLink ([www.KidLink.org](http://www.KidLink.org)) has won numerous educational Web site awards, such as the Stockholm Challenge Award in 1999, the Family Choice Award, an award from The Copernicus Online Community, and an Award of Special Merit—“The Cyber Golden Hearts” sponsored by the Special Interest Group for Telelearning (SIGTel) of the International Society for Technology in Education (ISTE), which is judged by an international panel (KidLink, 2001).

KidLink uses a form of interpersonal exchange, providing students with key-pals with whom they can exchange e-mail. It also allows students to engage in real-time IRC “chat” with other students globally.

## *iEARN*

Associated with ministries of education in more than one hundred countries worldwide, iEARN ([www.iEARN.org](http://www.iEARN.org)) sponsors classrooms joined in a “learning circle,” usually comprised of six to twelve globally diverse classrooms. This global, multicultural program has won many international awards, including a Global Schoolnet Award in 2002, the Stockholm Challenge Award in 1999, and an EdNet Hero Award in 1998 (International Education and Resource Network, 2005).

Classrooms in an iEARN learning circle exchange e-mail, often about common topics. For example, students might be asked to describe what they see when they look outside their classroom window. Exchanges that begin with simple descriptions often expand into whole-classroom discussion of curriculum-based topics, such as flora, fauna, geological formations, or climates.

## *ThinkQuest and ThinkQuest Jr.*

ThinkQuest (for secondary students) and ThinkQuest Jr. (for elementary students) are student-directed instructional Web site building competitions sponsored by the Oracle Corporation’s nonprofit Oracle Education Foundation ([www.thinkquest.org](http://www.thinkquest.org)). It was selected as a finalist in the Stockholm Challenge in 2004, and was named one of the top ten innovative programs for education by Tech\*Learning in 2003 (“Top Ten Innovative Projects,” 2003).

ThinkQuest competition projects are typically conducted as extracurricular, after-school activities. Competing teams usually consist of four students, frequently in different locations. Students research, design, and build instructional Web sites, while teachers act as coaches. Projects usually involve information searches and student collaboration during the early Web site design phase, with electronic publishing and problem-solving activities involved in the completion of student Web sites placed online. Teachers in this study who participated in ThinkQuest and ThinkQuest Jr. projects coached winning student teams in these competitions. One teacher’s student teams won top prizes several times.

## **Theoretical Framework**

This research draws on constructivism as a theoretical perspective, assuming a pluralistic and relativistic view of reality (Guba & Lincoln, 1998). In this view, teachers’ constructions of reality are local and specific in nature, relating to their own views of their classroom instructional roles and responsibilities, the specific instructional needs of their students, and their choices in terms of their classroom teaching practice. In the context of this study, research is seen as an intentional process of knowledge construction, which unfolds through a dialectic process of iteration, analysis, critique, and reiteration (Crotty, 1998) leading to a shared consensus with links to the data that is credible and relevant to the situation (Charon, 2001). The researcher is a participant and facilitator of this inquiry process, being actively engaged in becoming more informed and contributing to meaning construction across the participants’ multi-case construction of meaning about their experiences. The goal of the research is to increase understanding of a “complex world of lived experience from the point of view

of those who live it" (Schwandt, 1998, p. 221)—in this case, understanding about how teachers who integrate telecomputing projects into their classroom curriculum perceive this process in terms of their learning about their own teaching practices. This is consistent with a view of teaching as a "professional thinking activity" (Calderhead, 1990) in which reflection, conceptualization of instructional efficacy, and changes in practice to improve effectiveness are recognized as the core of teacher learning (Diamond, 1991).

### Research Questions

This research was guided by the following questions:

1. What, if anything, do teachers involved in curriculum-based online projects feel they are learning in terms of their professional development or in their growth as teachers?
2. How do teachers feel that professional growth—if any—is occurring, and if it is occurring, why do they think it is occurring?

### METHOD

Because this multi-case study explored teachers' self-reported beliefs and perceptions about their teaching practice, it was conducted as a naturalistic inquiry (Lincoln & Guba, 1985) to incorporate the teachers' descriptions and explanations of their experiences in their own words. This method of inquiry best suited the purpose of the research, which was to examine the individual lived experiences of these teachers in a specific context (Patton, 1990)—in this case, relating to their experiences while participating with their students in online curriculum-based projects. The intent of this study was to develop an understanding of the ways in which these teachers interpreted their learning (Schwandt, 1999) about their teaching due to their experiences. Naturalistic inquiry recognizes that the researcher is the primary research instrument and includes the experiences and perspectives of the researcher as valuable and meaningful factors contributing to the study (Lincoln & Guba, 1985). It allows for the use of inductive data analysis in multi-case studies to "engage in reasonable but modest speculation about whether findings are applicable to other cases with similar circumstances" (Lincoln & Guba, cited in Schwandt, 1997, pp. 58–59).

Research was conducted primarily by means of open-ended telephone interviews with participating teachers, supplemented by follow-up interviews and e-mail messages. Interviews with individual teachers were audio-taped and transcribed verbatim. Transcripts were coded and summarized, then member-checked with informants for accuracy of interpretation. Cross-case analysis was subsequently used to reveal patterns among the teachers' descriptions of their experiences and what they learned.

Transcripts were coded and summarized, then member-checked with informants for accuracy of interpretation (Erlandson, Harris, Skipper, & Allen, 1993). Cross-case analysis was based on principles of discourse analysis, using techniques of "analytic bracketing" to "reveal the lived interplay among social

interaction, its immediate surroundings, and its going concerns" (Gubrium & Holstein, 2000, p. 500). Use of this technique revealed patterns that emerged organically (Ryan & Bernard, 2000) from the teachers' descriptions of their experiences and what they learned. These patterns, across cases, were then organized into several general themes (Schwandt, 1997), which are discussed in the findings section of this report.

Participants for this study were a purposive sample, defined (Erlandson et al., 1993) as selected from among "sources that will most help to answer the basic research questions and fit the basic purpose of the study" (p. 83). Project administrators from the five telecomputing programs were asked to identify teachers whose students had successfully completed one or more online projects within the previous three years. A total of 22 teachers were recommended by the online project administrators of the five programs: The Electronic Emissary, seven; KidLink, five; iEARN, three; ThinkQuest, four; and ThinkQuest Jr., four. Because the online projects provided only these teachers' names and e-mail addresses to protect their privacy, all of these teachers were initially contacted through e-mail. The message sent to one teacher's e-mail address returned an "invalid address" notice. Eight other teachers sent no response to e-mail messages inviting them to participate in the research study. Among the 13 teachers who responded, two teachers declined to participate in the study, and of the 11 who initially agreed to participate, three later dropped out of the study because of their concern that their teaching responsibilities left them no extra time. This left eight participating teachers: two who had worked on Electronic Emissary projects; two on KidLink; one on iEARN; one on ThinkQuest; and two on ThinkQuest Jr.

The eight teachers who participated in this study were believed to be "information-rich" cases, meaning "those from which one can learn a great deal about the issues of central importance to the purpose of the research" (Patton, 1990, p. 169). The eight teachers—five women, three men—who participated in this study all taught ethnically, socially, and economically diverse students in U.S. public schools in varied locations (i.e., in geographically dispersed areas, including rural as well as urban settings), teaching varied subjects in elementary as well as secondary levels. All of these teachers had, within the previous three years, participated with their students in one or more projects provided by the five previously described online programs. These teachers were "information-rich" cases in that they were believed, on the basis of their having successfully completed one or more curriculum-based online projects with their students, to be in a better position to reflect about these experiences, comparatively speaking, than teachers who were in the process of planning or participating in their first online projects or who had less experience in using computers for curriculum-based projects with their students. There was no attempt in this study to provide a "representative" sample in a quantitative sense, and quantitatively what might seem to be a small sample (i.e., eight participants) might be viewed as a limitation. Rather, with this type of study, in which there is no claim to generalizability, these eight teachers were viewed as offering an experience-rich source of insights about their shared experience of including technology-based curriculum-related projects into their teaching.

As background, participating teachers were requested, through e-mail, to describe their students' completed online projects. Some teachers provided Web site addresses for students' completed projects posted online. Some sent e-mail logs of students' exchanges with other students or with adult coaches or mentors. These materials provided helpful background information for this study.

### **Data Collection and Analysis**

Initial interviews, lasting approximately one hour by telephone, began with each teacher being asked an open-ended focus question—what, if anything, they thought they learned during their involvement with their online projects that relates to their teaching.

Data analysis began with completion of the first interview transcriptions, which were marked into units of data, generally a sentence in length. Units of data were coded using words or phrases representing the main idea expressed in each unit. Coded words or phrases were subsequently analyzed to discern “themes,” or consistent connections or emerging patterns of meaning. Themes were analyzed for each participant case, then among all participants in cross-case analysis (Ryan & Bernard, 2000; Schwandt, 1998).

Two peer-researchers were asked to critique research for this study. They provided valuable feedback during planning, data collection, and analysis. Early drafts of this report were reviewed by these peer-researchers, and concerns they raised were addressed in revisions (Erlandson et al., 1993).

### **Case Studies**

Because they provide “thick description,” naturalistic case studies allow readers to develop mental pictures of the teachers' experiences (Geertz, 1973). Readers can then draw their own conclusions, particularly when identifying aspects of telecomputing teachers' experiences that may relate to their own experiences or understandings (Lincoln & Guba, 1985).

Individual participants' experiences with specific telecomputing projects are described in the section following. Pseudonyms were used to preserve confidentiality of teachers' identities. Individual-case sketches are followed by a cross-case analysis and discussion of findings.

## **INDIVIDUAL CASE STUDIES**

### **Leah**

A fifth-grade teacher, Leah had completed more than one online project with The Electronic Emissary. She described what she learned as changing her conceptions about how children learn and how best to teach them. An inquiry-based teacher before discovering online technology projects, she said she was initially “unsure how technology would fit in” to her classroom instruction.

Leah said involvement with a subject matter expert, or SME, online was rewarding to her students. She felt they benefited greatly from being able to “connect with someone else” and “learn from someone else online.” For some students, having an online correspondence with a SME was “a secret friendship with an online mentor” that “gave them another source of praise.” Students also



had “a sense of responsibility,” because if they did not complete their assignments, they felt their SME would be “disappointed.”

Leah said SMEs who were impatient or “strictly question-and-answer type people” usually did not develop rich relationships with students. Successful online mentors for students should “be tolerant of children who ask silly questions” and willing to discuss subjects that interested students. Leah and her students continued corresponding with one SME long after their project ended, and whenever “he found something he thought the students would like, he’d send it over.”

Leah’s students were always excited to receive e-mail from their SMEs. Leah’s class organization was flexible to allow students to share their new e-mails and then extend or blend this event into the day’s course of study, because “everything is related to whatever we’re doing.” She said their online projects provided opportunities for students to “teach each other” as well as to make presentations about what they learned to others, which helped “students become confident speakers.”

### Sue

Sue, an elementary-school technical coordinator, said what she learned from participating in ThinkQuest Jr. projects as a team coach was “how students go through the inquiry process” and “how to assist them and guide them in that process.” Her student teams’ goal was to design and construct a Web site that would subsequently serve as an instructional unit online.

Sue saw the development process as “inductive” in nature, because students needed to “formulate their own set of standards and rubrics of what they think a really good Web site, an *engaging* Web site, would be.” Students researched their chosen topics, then designed and built their Web site collaboratively with teammates, some of them in distant locations.

When her team won a top competition prize, many other students then wanted to become involved. Sue recruited other teachers as coaches, and parents enlisted as well, creating a complex community of learners acting as mentors and providing support for the student teams.

Members of winning teams one year were required to join different teams the next year. This allowed students to teach other students, as Sue explained:

The veterans ... mentor the others. The whole process of taking the lead is nice because the children get very good at articulating their process, and ... being aware of how they’re learning—which is rather sophisticated, I think, for kids in fourth, fifth, and sixth grades.

Sue’s students frequently presented their projects to other classes or spoke to adult groups. For example, Sue and a winning team of three ThinkQuest Internet Challenge students (Grades 7–12) were invited to speak about their experiences at a series of workshops for teachers in Europe.



## Terry

Terry, a fifth-grade teacher, said his KidLink projects “bring the real world into the classroom” and “make the learning alive” by providing both meaningful activity and motivation for students. An online e-mail exchange between his students and a class in Africa motivated his students to do higher-quality writing:

It's amazing how they begin doing self-evaluation when they realize that peers in other parts of the world are going to be reading their writing. Those are huge incentives for learning right there.

Terry said students benefited most when the learning community as a whole, including teachers, parents, principals, and students, worked toward the shared goal of supporting and valuing students' learning. Terry's students gained self-control “because they're not just in their seats doing as they're told; they're acting like real people and have to regulate their actions themselves.”

Terry said he realized online projects provided “another way to let kids know that they're a part of the world, and that the things we study and talk about are going to come from the real world.” He felt this was motivating to students, because “you're not just opening a book and saying, ‘You need to know this,’ [because then] kids will say, ‘Why?’” Terry's elementary students often had difficulty seeing the relevance of textbook content, but their curriculum-based telecomputing projects helped students make personal connections and feel their learning was meaningful to them.

Terry said, “The more involved teachers become with these projects, the more they are attracted ... into new areas of knowledge and experiences.” For example, Terry went to Great Britain to meet teachers with whom his students had been working:

I got to meet the kids and my partner teachers invited me to teach in their classrooms while I was visiting. Talk about unexpected professional development! My traveling and growth would not have happened if I hadn't been doing Internet projects.

## Ted

Ted, a high school language arts teacher, had completed several projects with The Electronic Emissary. He said students participating in online projects feel “they have choice in what they're going to do.” This choice gave students freedom, because with telementors, students “can choose to take that particular advice or not, but there's no repercussion, like failing the class. It's a different kind of relationship.” With online mentors, students benefit from “many different voices helping ensure that students learn particular projects from different vantage points.” Ted said the use of online resources changes classroom instruction because it “gives students an opportunity to broaden their horizons” by providing access to “different kinds of information as well as different kinds of people.”

Ted said he had not seen standardized test scores rise as a result of online project involvement, but he had seen tangible benefits in his inner-urban high school, such as students' increased attendance in school and decreased trouble with police. Ted approved of changes inherent in "an online communications-based classroom," but he thought that to other teachers, the experience "would be earth-shattering—giving up all that control, sharing your classes with another person, another teacher" like a project SME, even though education "is supposed to be about what's best for the student."

### **Rick**

A third-grade teacher, Rick had been involved in several ThinkQuest Jr. projects. He said changes in his teaching resulting from his experiences had not been just "one dramatic change." Over time, though, he found it "easier to do the kinds of online projects that are really exciting." Rick described coaching student teams as "rewarding" and "fun," but also said "it was very draining, because it took a lot of extra time." He felt the online project benefited students involved, saying, "It would have still been a great project, even if we hadn't won anything."

Rick described his students' excitement when they received e-mail from distant places such as New Zealand and Ireland. His students quickly tried to find these places on the map. Rick said the speed, convenience, and low cost of e-mail made online projects much more effective than their predecessors, international pen pal exchanges.

Rick described reactions of "reluctant" teachers who were "intimidated" by computers, saying, "It's very difficult to convince those people that there is something worthwhile" in working with computers in the classroom. Rick thought that, in part, traditional teachers might be "afraid that the kids might know more than they do," which was "a very vulnerable position for a teacher to be in," although, he added, "if you're going to be a teacher, you have to be a life-long learner."

Rick's award-winning ThinkQuest Jr. team was excited that the Web site they built several years previously had continued to receive attention, with several thousand online visits or "hits" during the current school year. Recently, the original team reassembled to make updates to the site, even though the students had moved up to the middle school. Rick found it amazing that the students from the team still felt such a sense of ownership and that "they're still willing to put time in to work on it." He saw benefit in having the students "get to be teachers" through their Web site.

### **Zeni**

A fifth-grade teacher, Zeni was the newest and least experienced among the teachers interviewed about using computers and online communications with her classes. She first learned about KidLink when attending a conference of computer teachers, saying, "You just get exposed to all that stuff, and you can't help getting excited about it."

While preparing for her classroom participation in online projects, Zeni learned more about telecomputing and how to integrate online project-based

learning activities into her classroom. When she saw that technology use heightened her students' interest, she felt that it motivated her students to learn.

Zeni said that sometimes "the people that we have to 'get permission from' really do not understand the extent of what we're doing." For example, when her principal brought some school visitors to her computer-using classroom, her students were working on an approved curriculum-based lesson. However, when the visitors saw students seated at the computers, they immediately assumed the students were "just playing."

Zeni said she has had many more people come to her class as visitors since her students began using computers. Some came because her class was being showcased by administrators, but students' increased use of inquiry-based learning also prompted them to contact more community people for information or for appearances as guest speakers in the classroom. Zeni said her students now "can see that school life has benefits ... related to the real world."

### **Mary**

Mary, an elementary-school technology coordinator, had been involved in several iEARN projects, from which she had "learned more about cooperative learning." She said she also learned more about "the whole writing process," because students saw more relevance when they were "writing about real topics." Mary said that participating in an online project helped students "to have an identified audience," which improved their writing by focusing their attention on precision in expression and spelling. Several classes in Mary's school wrote e-mail as part of their iEARN learning circle exchanges with classrooms in other regions of the United States as well as classrooms in Europe. Students were thrilled with their e-mail exchanges, and even the most technologically reluctant teachers were impressed by students' increased interest.

As the school's technology coordinator, Mary has assisted, urged, and "sometimes prodded" teachers who were "interested, but technophobic." She noted that more teachers were beginning to get involved in telecomputing projects in all subjects, because "the projects are all multi-curricular."

Mary's technology lab has been held up as a model in the district, with visits regularly by "moms and some of the community groups." Mary said the students enjoyed making presentations for visitors. The continuous attention has prompted Mary to "spiff up" her demonstrations using PowerPoint and graphics programs.

With Mary's school district' expenditures of equipment and Internet connections, they would prefer online projects to have more visible benefits, but as Mary said, "I can't tell you that writing scores have gone up, but after 23 years of teaching, I just know that my students are learning better—and that's half the battle."

### **McKinley**

McKinley, a high-school technology coordinator, said her involvement with ThinkQuest competition projects helped her students gain a valuable real-world experience that "opened the door" for some of them.

In projects McKinley coordinated, communications took place almost exclusively online, because student team members lived in distant locations around the globe. McKinley felt that her students took ownership of their project:

When kids find a topic that they're really interested in, they will do an incredible amount of work! But if it's something that they're not interested in, it's like pulling teeth to get them to spend any time on it.

Students recognized the need to scrutinize “every little tag” of HTML code, lest Web pages not display as they intended, so “the kids were very tuned in—to detail, and precision, and accuracy.” Students initially did not pay the same kind of attention to grammatical correctness in their e-mail messages, but McKinley explained that for the “same reasons that you’ve learned that you have to be letter-perfect on your [HTML] scripting, you should also show the same regard for the use of the English language,” and they finally understood.

McKinley’s team won a top prize and was flown to the award ceremonies, where the student team members as well as coaches, who had all become friends online, enjoyed a particularly satisfying part of the reward—they finally got to meet one another face to face.

Other teachers’ reactions to McKinley’s online projects varied. She said teachers “who have to be at the head of the class all the time are not comfortable with using the technology, because it’s just a different learning style.” Some teachers expressed interest in projects McKinley did, but few volunteered for similar projects. McKinley thought this probably indicated that “teachers have been burdened with so many things to be doing, I don’t think most people are looking for one more thing to add to the plate.”

## CROSS-CASE ANALYSIS

Themes that arose in cross-case analysis in this study related to the research focus on telecomputing teachers’ perceptions about what they felt they learned in the course of their involvement in the telecomputing projects, or—as termed in this report—“authentic professional development.”

### Improving Students’ Learning

These teachers were all primarily interested in improving their students’ learning, and they were willing to give much effort and time to make it possible for their students to participate in online projects. Following are statements each of the teachers made in describing their reasons for doing the online projects and the benefits they thought these projects provided their students:

**Leah:** Students “are learning, they’re enthusiastic, they want to bring things to school ... They become so confident ... what they’ve done is validated [by their project mentors online].”

**Sue:** The projects allow “really high-level kinds of thinking skills, for the kids taking the lead. ... There is just so much thinking and problem solving [that

it's worth it if some of] the skill that they gained in analysis and organization would carry over" into their future learning abilities.

**Terry:** Students "like to come to the classroom. ... Parents know what's going on, because kids go home excited. ... I really saw amazing gains ... in writing and reading" with the students' exchange of e-mails with children in other countries.

**Ted:** Students feel that "they have control; ... they have choice. ... If a kid can pick up a couple of mentors ... then you have many different voices helping that student learn particular subjects from different vantage points."

**Rick:** Students "were more than willing to put the time in [after school]. ... For some [students, the motivator] was the prospect of doing something cool, that was going to be visible on the Internet. ... Some of the benefits [to students] are real obvious, and others are not so obvious, [but are real]."

**Zeni:** Students are "taking a responsibility. They can't go [online] and ... be rude to people. They have to read the rules, and ... all that is a learning process for the kids. They learn courtesy, and that those are real people [they're communicating with online]. ... They're looking [at the colored pins on the class map] all the time to see how many countries we have contacted. I think that helps [them be motivated], to be more real."

**Mary:** "It really is a lot of fun. ... You can get the kids to write and to stay on topic, which really helps them because they have an identified audience ... [They know their e-mail] is going to be read worldwide."

**McKinley:** "I think the involvement [with online projects] really opened the door for some of the kids. They were interested in technology, but they weren't necessarily doing real constructive things with it. ... [The project] kind of helped give them a little more sense of direction, and a sense of the possibilities of what they could do with it."

### Reflection, Teaching Style, and Teaching Effectiveness

One consistently notable characteristic of these teachers, when talking about their teaching practice, was that they seemed to reflect continuously about the effectiveness of their teaching. The online projects in which they participated did not make them that way, however. If anything, the reverse was true: Because these teachers were continuously thinking about and trying to find ways to improve their teaching effectiveness, they sought out telecomputing projects that they could see were interesting and motivating to their students. Many of these teachers described their teaching practice before doing online projects, to emphasize that their practice had not fundamentally changed because of those projects:

**Leah:** "When technology came along, that's why I embraced it, because for me, I had taught that way, anyway—inquiry-based learning. The technology just facilitated that by broadening the base of inquiry."

**Sue:** "[My regular classes are] interdisciplinary—three grade levels (fourth, fifth, and sixth) with the class—working project-based [and doing a lot of] problem solving."

**Terry:** "[I've always tried to] let the students know that they're a part of the real world, and the things we study and talk about come from the real world ...

Internet projects [have reinforced that idea], because it is such a good integrator. We can do mathematics, geography, history ... and all of this stuff creates something for the kids to talk about meaningfully.”

**Ted:** “I’ve been interested in authentic assessment for the students for several years now—portfolios, peer review, and so on. ... It’s just that now the students can post Web-folios and get feedback from adults in careers [they’re interested in] online.”

**Rick:** “I’ve been into online projects for a long time at one time or another, so I’ve been trying to incorporate them into my teaching for a long time. ... I don’t think that there’s been much of a change [in my teaching style].”

**Zeni:** “[My teaching was always” project oriented], but when I first started teaching, my classroom was my own little world. [With online projects], it’s not that way anymore and I’m glad.”

**Mary:** “My job [as tech coordinator] is really to help teachers with classroom projects, so I’ve always been doing project-based learning. [With the computers,] there’s more about cooperative learning ... as cooperative groups.”

**McKinley:** “It’s as though the involvement [with the online project] supported what I already believed about teaching. ... I do everything as project-based learning.”

### **Network Connectivity Can Increase Local Connections to the Classroom**

Although these teachers did not feel their basic teaching styles changed as a result of their participation in online projects, many of them specifically mentioned the following effects that they felt their telecomputing project experiences had on their classroom teaching:

1. They became more aware of connections to other teachers and administrators in their schools, who became more interested in what they were doing in their classrooms when these teachers began to be involved with curriculum-based online projects. (Six of the eight teachers—Leah, Sue, Terry, Rick, Zeni, and Mary—specifically mentioned these connections.)
2. They became more aware of others in their communities, including visitors and parents, as valuable information resources as well as helpers and supporters. Several teachers’ telecomputing projects had the unexpected effect of increasing involvement of parents and local resource people in face-to-face classroom activities with students. (Five of the eight teachers—Sue, Ted, Rick, Zeni, and Mary—specifically mentioned this increase in community involvement.)
3. They became more aware of the broad community of learners available through telecommunication. The isolation of classroom teaching lessened considerably when others were invited, through the Internet, to “team teach” in the classroom. (Six of the eight teachers—Leah, Sue, Ted, Terry, Rick, and Mary—specifically identified this effect.) Some teachers thought this “sharing of the teacher role” might be particularly disturbing to more traditional teachers. (Four of the eight teachers—Leah, Ted, Rick, and Mary—specifically mentioned other teachers’ possible resistance to technology on this basis.)

## DISCUSSION

Some broad themes that emerged from this study have been mentioned by other researchers. For example, teachers interviewed for this study said their primary motive for becoming involved with online projects was to provide better learning experiences for their students. This is similar to McGee's (1998) finding that, for teachers engaged in online telementoring projects, "... individual student learning needs were of greatest concern to the teachers" (p. 51).

### Pre-Existing Project-Based Teaching Practice

All of the teachers in this study said they did not believe their online projects altered their basic teaching practices, which they described as already being basically "inquiry-based" or "project-based." This finding confirms those of another research study (Dexter, Anderson, & Becker, 1998) that concluded there was "a strong need to revise the image of computer as catalyst of instructional change" (p. 237) and that teachers' already-existing beliefs about their practice helped them choose to participate in educational telecomputing projects:

The teachers who had adopted more progressive teaching practices over time felt that the computers helped them change, but they did not acknowledge computers as the catalyst for change; instead they cited reflection upon experience, classes taken, and the context or culture of the school. (p. 221)

### Teachers' Self-Taught Technology

The above description fits the teachers in this study in that they did not feel their telecomputing experiences made them change their basic teaching methods and in terms of their continuous reflection about their teaching experiences and instructional effectiveness.

In terms of classes taken, among the teachers in this study, only three of the eight participants—the three technology coordinators (Sue, Mary, and McKinley)—had taken formal classes to increase their knowledge of computer use and Internet tools. Among the other five participants, the closest approximation of professional or instructional support was experienced by Zeni, the teacher newest to using technology in her classroom, who first learned about telecomputing projects during attendance at a professional conference. Teachers participating in this study chiefly taught themselves technology use, with several (Leah, Ted, Terry, and Zeni) specifically remarking that they had no formal classes, including inservice sessions, that helped them use computer-based or Internet tools. However, having used telecomputing tools in ways they felt benefited their students, some of these participating teachers (Sue, Rick, and Mary) are now helping teach other teachers about integrating use of technology into their classrooms.

These computer-project participating teachers resemble "early adopters" (Rogers, 1995), who typically change or adopt new innovations in advance of the majority of people in their social systems, such as in their schools or districts, and whose innovative actions frequently influence others in favor of following their leads.



## **Social Climates Affect Acceptance of Classroom Technology Use**

Although these teachers were running somewhat ahead of the curve in their schools in adopting new tools for use in their teaching, the teachers in this study were all sensitive to the social climates in their schools. Most of the informants (Leah, Terry, Rick, Zeni, and Mary) were aware of and described the views of administrators and their fellow teachers about their use of technology with their classes.

Reactions of others in the social culture of the teachers' schools varied widely. Some participants' administrators welcomed these teachers' pioneering use of telecomputing and "showed off" their classes to visitors as exemplary (Leah, Zeni, and Mary), but other school administrators were suspicious—even hostile—to a few teachers' (Leah and Zeni) use of technology. One administrator in Leah's school district declared that the Internet was "evil," and school officials in another district nearby actually disconnected a teacher's classroom telephone line so that it could not be used to access the Internet. By contrast, Mary, one of the technology coordinators, said that she was asked to conduct technology-focused professional development sessions for her district administrators, who were interested in how the technology could be used to best effect in their school's classrooms.

Views of technology-using teachers by other teachers in their schools also varied widely. Some participants (Leah, Ted, and Terry) thought that other teachers resented their use of technology in their classrooms; some (Sue, Zeni, and McKinley) felt ignored by other teachers who were not interested in technology use; and some (Rick and Mary) said that a few other teachers were interested and invited their assistance in learning how to integrate technology into their own classrooms.

These differences in perceived attitudes may reflect differences in social climates inside schools or in school districts. For example, Hargreaves (1994) said that the culture of a school and the context in which teachers work greatly encourages or discourages changes in teachers' practice. Even outsiders varied in their opinions about these teachers' technology use in their classrooms. Some, like parents Sue described, saw students' involvement in online projects as exciting and actively supported it. Some, however, were like the visitors to Zeni's classroom who interpreted students working at classroom computers as "playing."

The social context of a school is important in planning for change. For example, Lieberman and Miller (1991) pointed out that to foster positive and progressive change, staff development should address culture-building within the school as well as encouraging individual teachers to reflect upon and actively implement changes in their classroom practice.

Teachers in this study were generally acting as agents for change to other teachers, not only by example, but also—in places where the school culture and other individual teachers welcomed it—by being actively involved in conducting formal or informal professional-practice instructional sessions for others.

## **Perceived Effects of Participation in Online Projects on Students**

All of the teachers in this study commented about seeking out curriculum-based telecomputing projects because of their students' heightened interest and

increased motivation to learn when working on various types of computer-based online projects. These online projects, as Rick pointed out, involved “a lot of extra time” for teachers. To all of the teachers in this study, however, the extra effort required to allow students to participate in curriculum-based online projects was worthwhile because of the benefits to their students. As described by the teachers, their students gained in the following ways:

1. Students improved their writing and speaking skills. They felt motivated to improve their message effectiveness, precision, and accuracy of expression because they had an interested audience of other students as well as adults. Students gained confidence, effectiveness in written and spoken expression skills, and presentation skills that thrilled their teachers (specifically described by seven of the eight: Leah, Sue, Ted, Terry, Zeni, Mary, and McKinley).
2. Students demonstrated an increased self-directedness. While they were involved in the online projects, they sought out and explored knowledge resources of all kinds, essentially on their own (specifically described by seven of the eight: Leah, Sue, Ted, Terry, Rick, Mary, and McKinley).
3. Students benefited from the opportunity to teach others. During the course of their participation in online projects, students learned things they felt were meaningful, and they—especially the younger students—were excited that others wanted to hear about what they had learned (specifically described by the six elementary-level teachers: Leah, Sue, Terry, Rick, Zeni, and Mary).

Engaging in telecomputing projects did not, by itself, change these teachers’ beliefs about their roles as teachers. Participating in curriculum-based online projects did not, by itself, cause these teachers to become more reflective. However, among teachers who make effective use of telecomputing projects in their classrooms, taking part in these types of activities may offer opportunities to improve students’ motivation and interest as well as to help students feel connected to authentic, relevant, and personally meaningful knowledge and experiences. For reflective and conscientious teachers, such activities also seem to offer opportunities to learn about their teaching as part of a larger community of life-long learners—including students in their classrooms, students outside their classrooms, parents, mentors, and subject matter experts, as well as college and university supporters of education and many others. It may thus offer opportunities for teachers to reach beyond their classroom walls to do a type of job-related, greater-context professional learning—or “authentic professional development”—not easily provided by other means.

## **SUGGESTIONS FOR FURTHER RESEARCH**

Research on authentic professional development as a logically generalizable phenomenon has been conducted among 336 Internet-using teachers from thirty countries by Harris and Grandgenett (2002). There is room for more research on teachers’ use of curriculum-based online projects, the effects of these

projects on student learning, and the use of these projects and how they contribute to the teaching effectiveness of teachers who participate in these types of projects.

### Contributor

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